

KEY TERMS

$$2x^3$$

This is an example of
a:

?

$$3x+2$$

?

$$5x^2+1=2$$

?

value.

Quickfire Examples – Collecting ‘Like Terms’

?

?

?

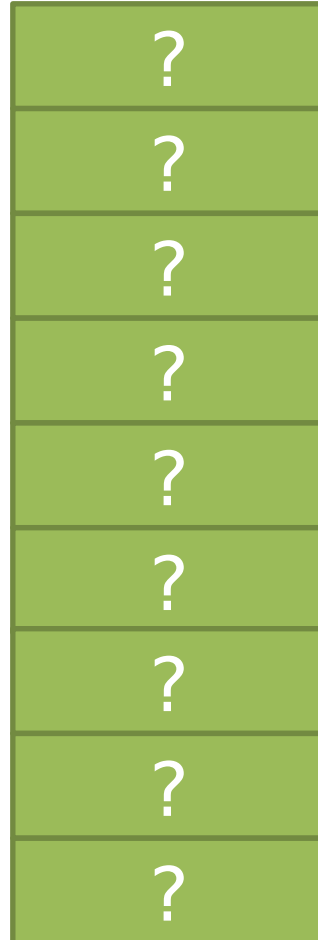
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Recap: Terms are ‘like’ if they have the same variables and the same powers.

Multiplying

In algebra, **we don't like the symbol**; instead we put things **next to each other** to indicate they are multiplied.

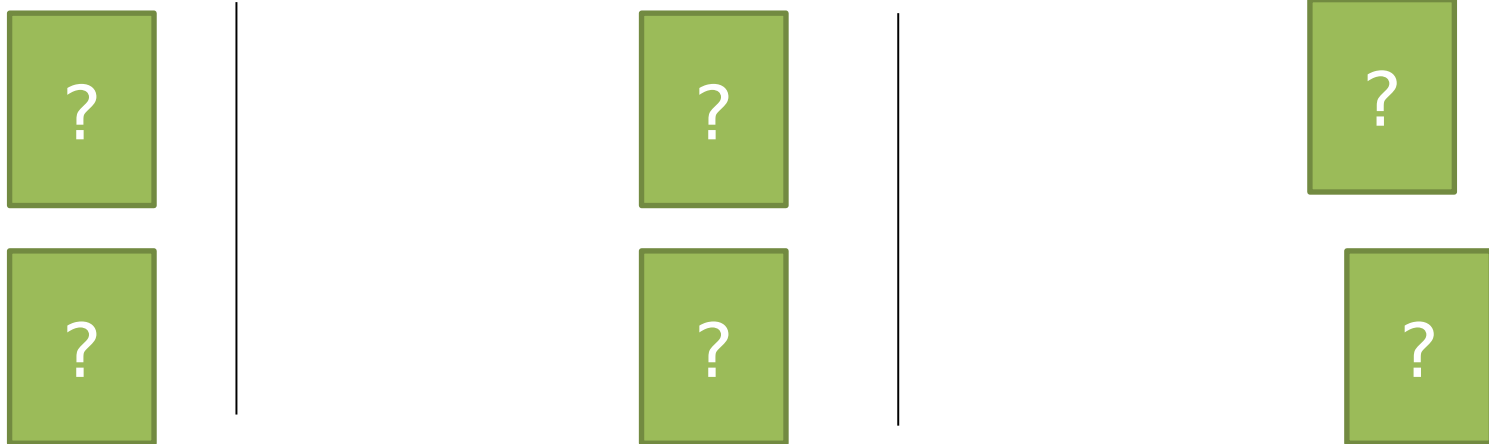


Division

$$\frac{6}{9} \rightarrow \boxed{?}$$

Fractions are ultimately just divisions. How did we simplify this fraction?

Can we apply the same principle to algebraic division?



Test Your Understanding

?

?

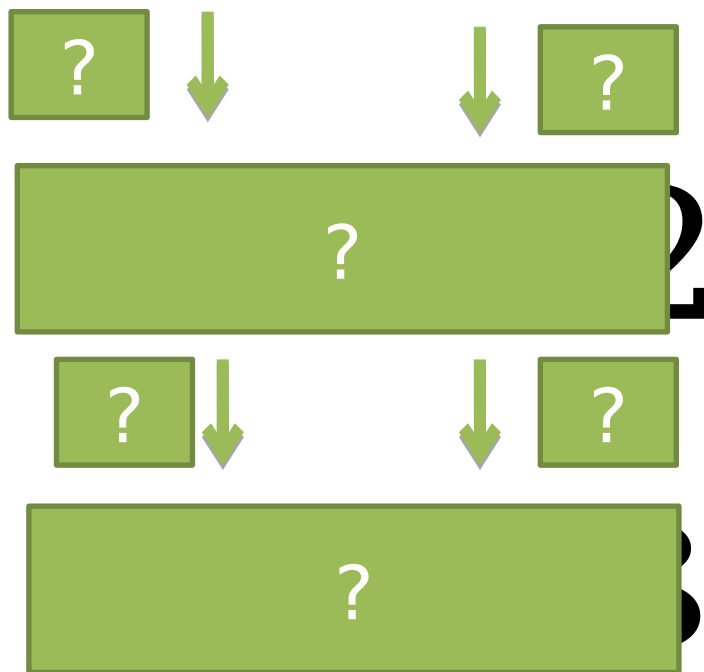
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?

Solving

Bro Note: You can probably see the answer to this in your head because the equation is relatively simple, but this full method is crucial when things become more complicated

$$4n + 20 = 32$$



Bro Tip: Many students find writing these operations between each equation helpful to remind them what they're doing to each side, but you'll eventually want to wean yourself off

Strategy: Do the opposite operation to 'get rid of' items surrounding our variable.

$$x + 4 \xrightarrow{\text{?}} x$$

$$3y \xrightarrow{\text{?}} y$$

$$\frac{z}{6} \xrightarrow{\text{?}} z$$

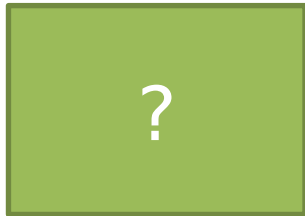
Test Your Understanding

Solve the following.

1



2



3



4



What happens if variable appears on both sides?

$$5a + 3 = 2a + 9$$

What might our strategy be?

?

What happens if variable appears on both sides?

equation

Let's move the "other side" terms to the left (as $5 > 2$) and the constants to the right. This is to get rid of the constant term on the left.

there's more of them (and move constant terms to

$$5a + 3 = 2a + 9$$

-3 -3

$$5a = 2a + 6$$

$$3a = 6$$

$$a = 2$$

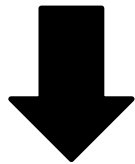
$$a = 2$$

$$a = 2$$

We could have done these two steps in either order.

More Examples

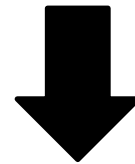
$$11x - 4 = 2x - 13$$



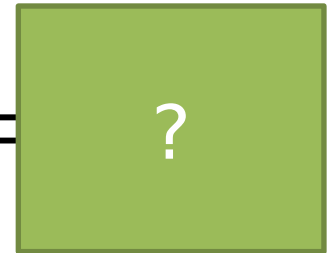
$$x =$$



$$3y + 4 = 8y - 5$$

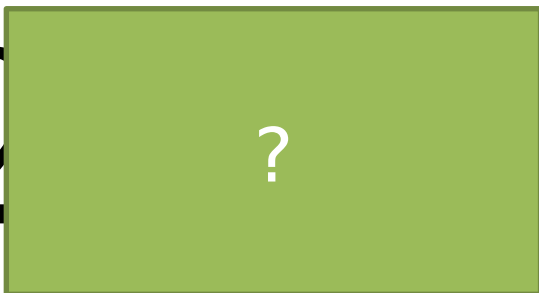


$$y =$$



Way we'd have previously done it.

2
4



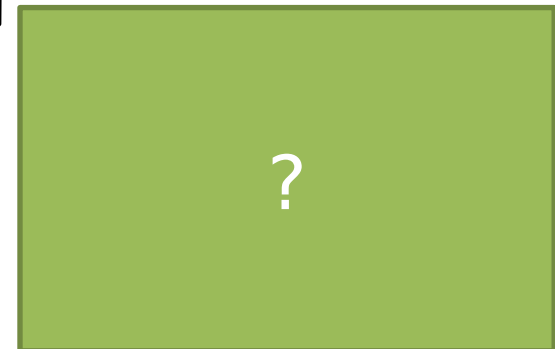
$$5 = 3 - 3$$



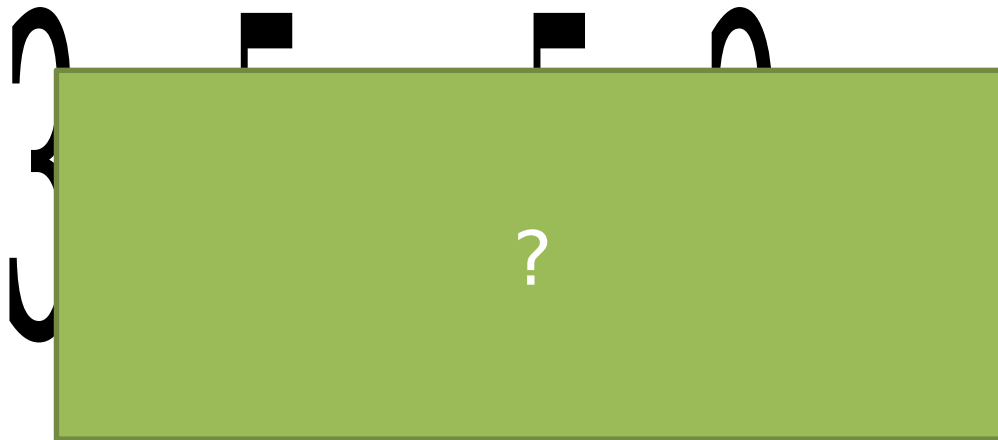
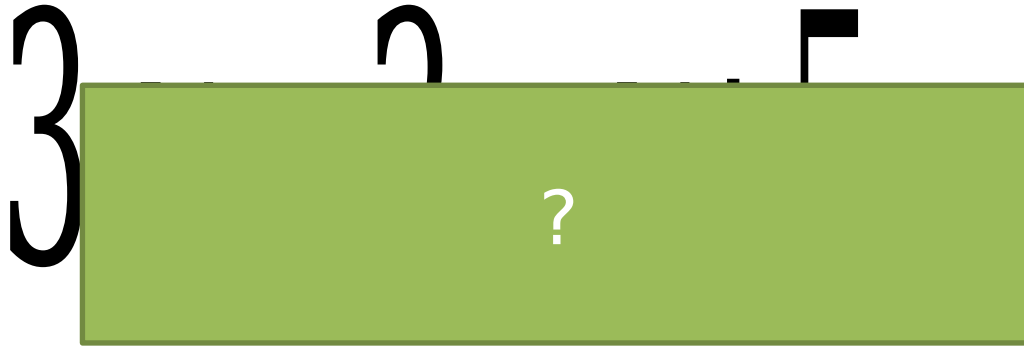
Both methods are valid, but I prefer the second - it's best to avoid dividing by negative numbers, and is less likely to



Or where we put term on side where

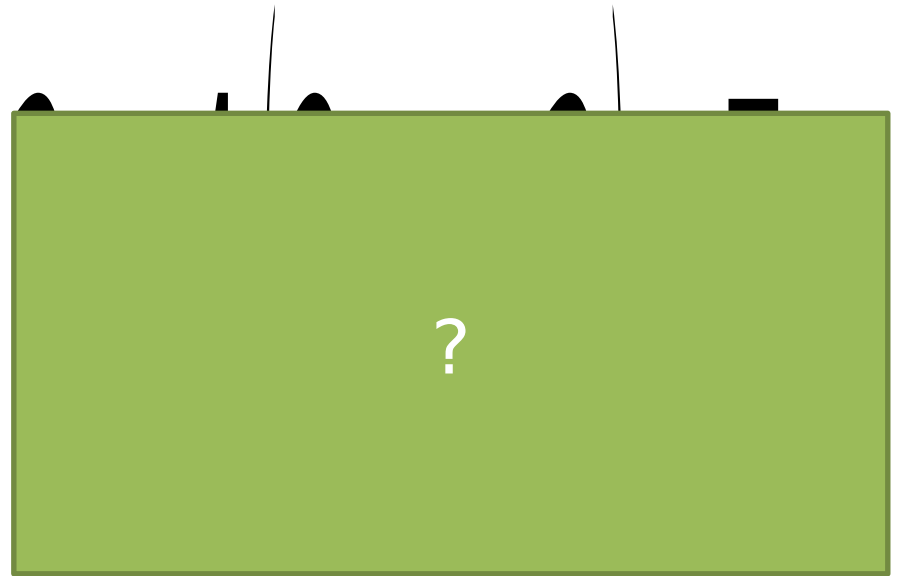
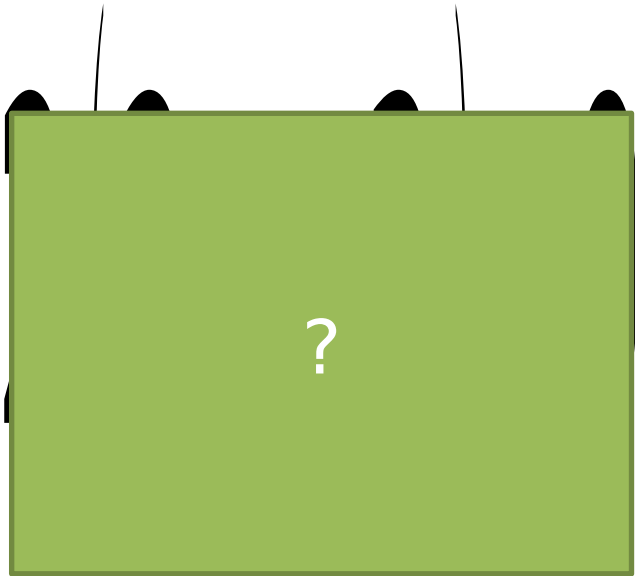


Test Your Understanding

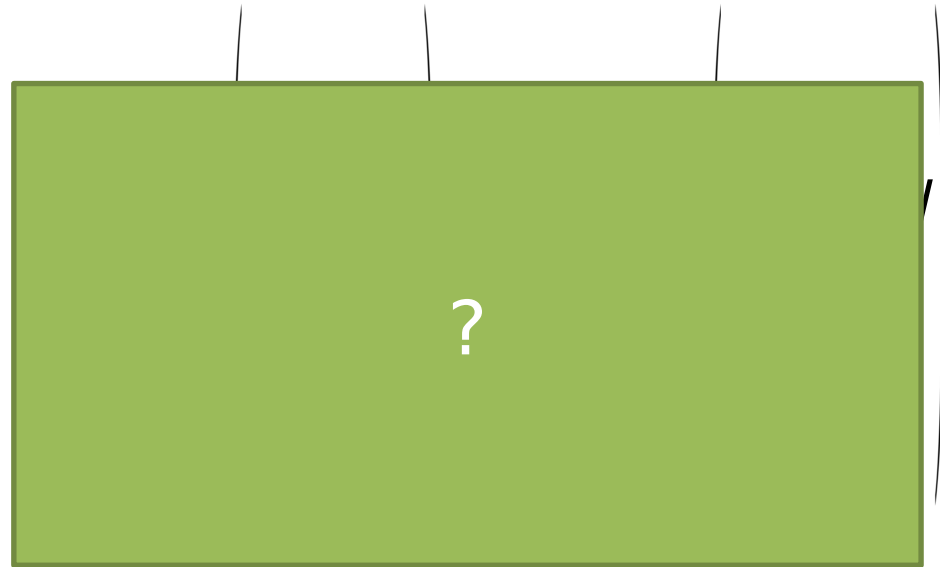
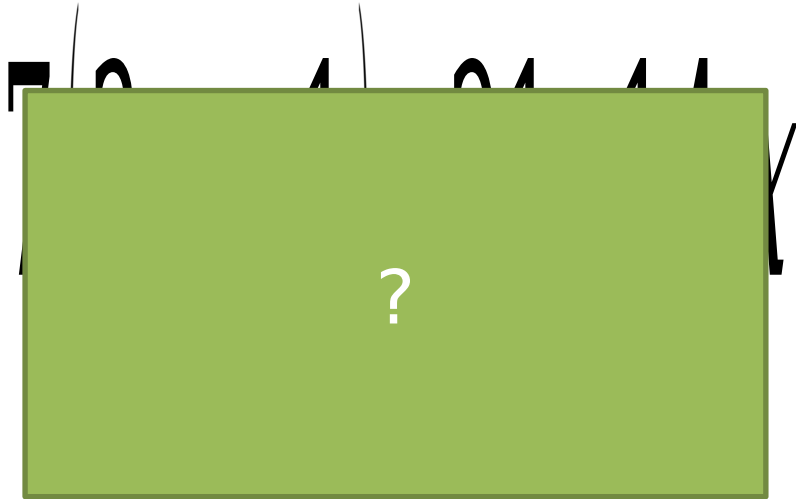


Dealing with Brackets

If there's any brackets, simply expand them first!

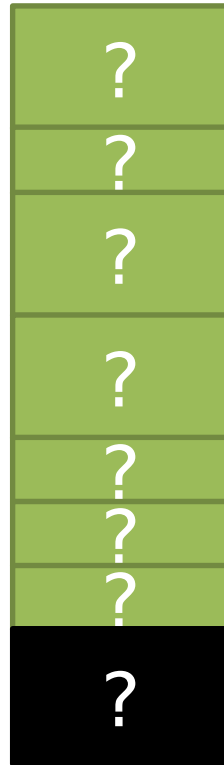
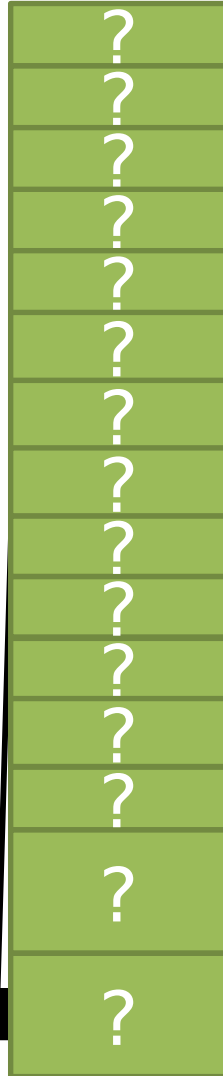
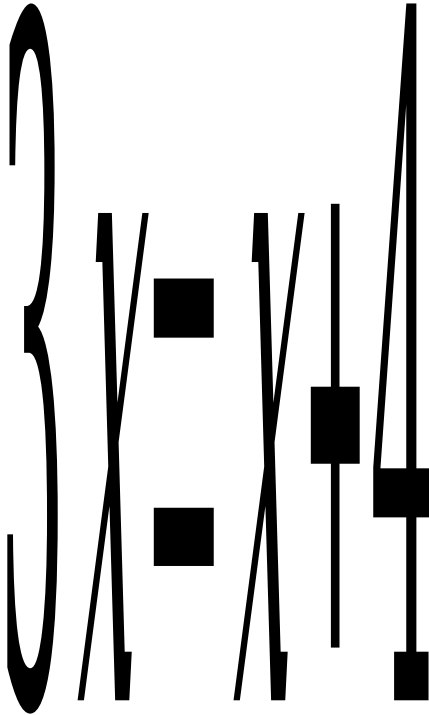


Test Your Understanding



Exercise 1

Solve the following.



RECAP :: Forming/Solving Process

Worded problem

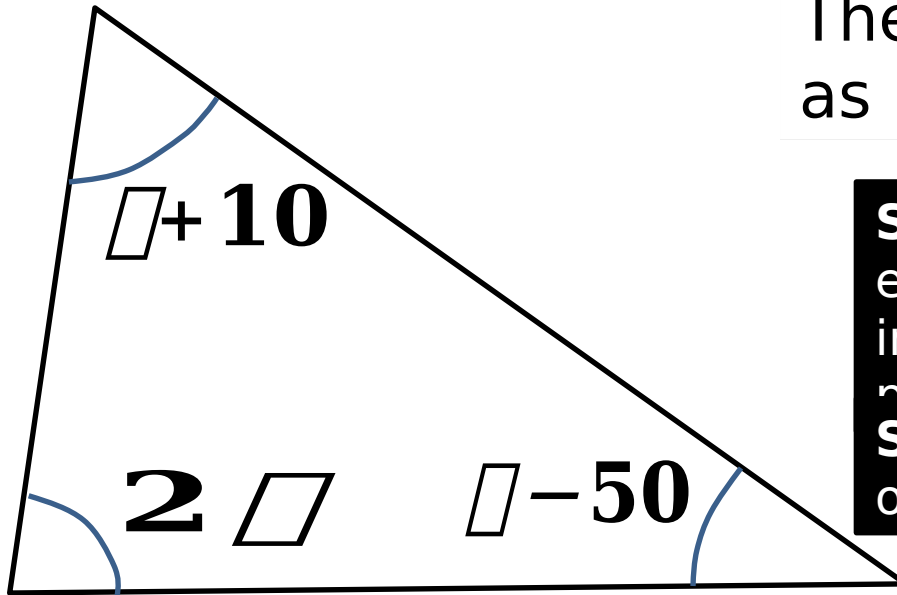
[JMC 2000 Q10] Granny swears that she is getting younger. She has calculated that she is four times as old as I am now, but remember that 5 years ago she was five times as old as I was at that time. What is the sum of our ages now?

Stage 1: Represent

Let x be my age
and y be Granny's age.

Stage 2: 'Solve' equation(s) to find

Example



The angles of a triangle are as pictured. Determine .

Step 1: Find two different expressions for the thing of interest (one of them often a provided number)

Step 2: Set them equal to each other

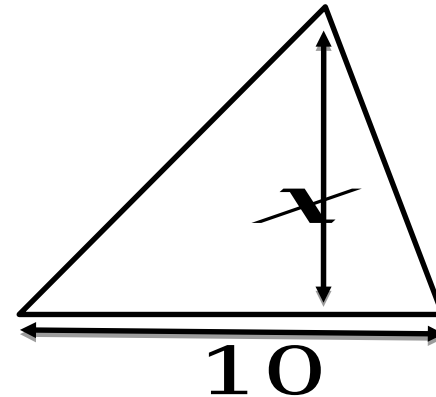
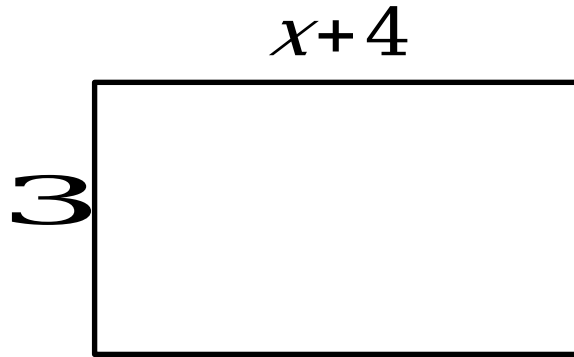
Step 3: Solve!

Expr 1?

Expr 2?

Solve!

Another Example



The rectangle and triangle have the same area. Determine the width of the rectangle.

Step 1: Find two different expressions for the thing of interest (one of them often a provided number)

Step 2: Set them equal to each other

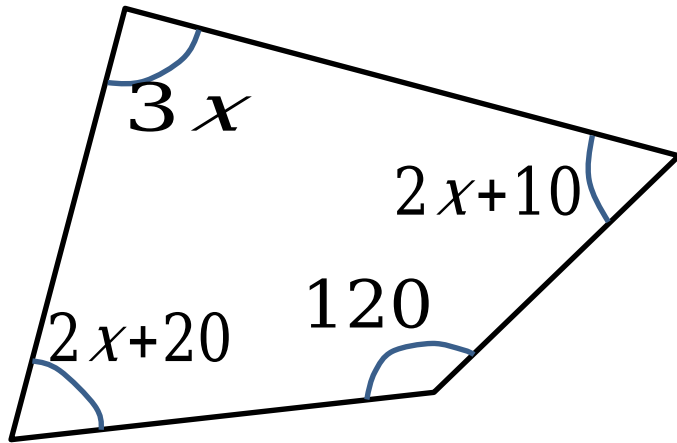
Step 3: Solve!

Expr 1?

Expr 2?

Solve!

Check Your Understanding



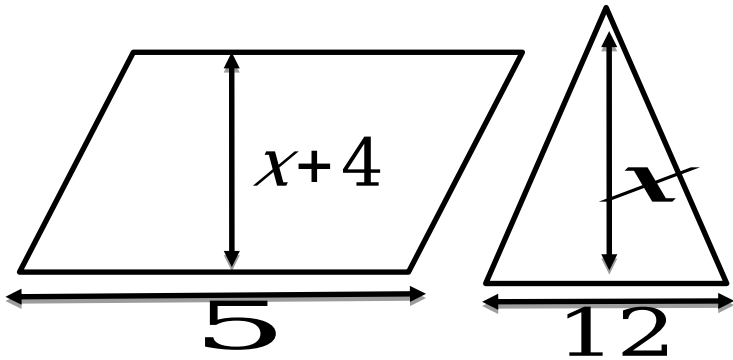
- 1 The following diagram shows the angles of a quadrilateral. Determine

Expr 1?

Expr 2?

Solve!

$$3x + 2x + 10 + 120 = 360$$



- 2 The area of the triangle is 1 more than the area of the parallelogram. Determine

Expr 1?

Expr 2?

Solve!

N

[JMO 1999 A9] Skimmed milk contains 0.1% fat and pasteurised whole milk contains 4% fat. When 6 litres of skimmed milk are mixed with litres of pasteurised whole milk, the fat content of the resulting

?

Forming the expressions yourself

Thomas is 5m shorter than Sebastian. Raul is double the height of Sebastian. Their combined height is 35m. Find Sebastian's height

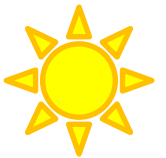
?

?

?

Use the word "Let ..."
to define your
variable(s)!

You want a clear
narrative while been
as concise as
possible.



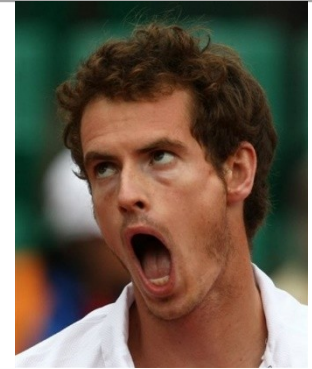
S
10

's height is



More Examples

[JMC 2013 Q7] After tennis training, Andy collects twice as many balls as Roger and five more than Maria. They collect 35 balls in total.



?

[TMC Regional 2014 Q9] In a list of seven consecutive numbers a quarter of the smallest number is five less than a third of the largest number. What is the value of

?

Test Your Understanding

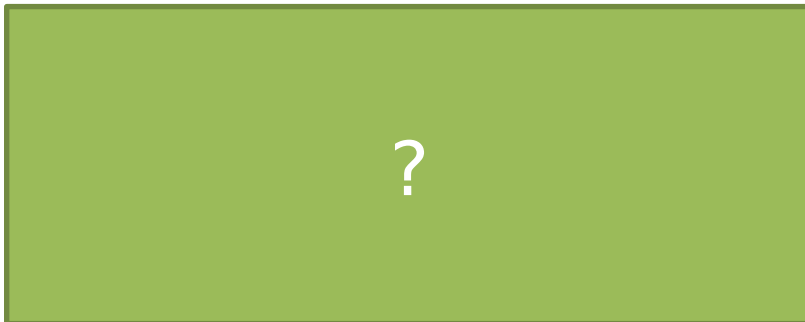


- 1 The width of the rectangle is three times the height. The total perimeter is 56m. Determine its height.



Bro
Reminder: You should usually start with “Let ...”

- 2 In 4 years time I will be 3 times as old as I was 10 years ago. How old am I?



Exercise 2

(Teacher Note: For printout see "Year 7 - Equations Ex3" -

<http://www.drfrostmaths.com/resource.php?id=11640>

1 Three angles in a triangle are and . What is ?

?

2 Two angles on a straight line are and . What is ?

?

3 The area of this rectangle is 48. Determine .

4



4 An equilateral triangle has lengths . What is ?

?

5 [JMC 1998 Q18] The three angles of a triangle are , , . Which statement about the triangles is correct? It is:

- A right-angled isosceles
- B right-angled, but not isosceles
- C equilateral
- D obtuse-angled and isosceles
- E none of A-D

s

?

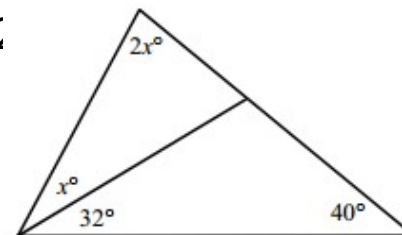
6 The sum of 5 consecutive numbers is 200. What is the

?

realise the middle number is the average of the 5, i.e. 40)

7

[JMO : value



he hown?

?

8

Solution: 36

?

The perimeter of this rectangle is 44. What is ?

Solu



$x - 2$

Exercise 2

9 In 5 years time I will be 5 times as old as I was 11 years ago. Form a suitable equation, and hence determine

?

10 In 6 years time I will be twice as old as I was 8 years ago. Determine my age.

?

I have three times as many cats as Alice but Bob has 7 less cats than me. In total we have 56 cats. How many cats do I have?

?

11 [TMC Final 2012 Q1] A Triple Jump consists of a hop, step and jump. The length of Keith's step was three-quarters of the length of his hop and the length of his jump was half the length of his step. If the total length of Keith's triple jump was 17m, what was the length of his hop, in metres?

?

Solution: 8 metres

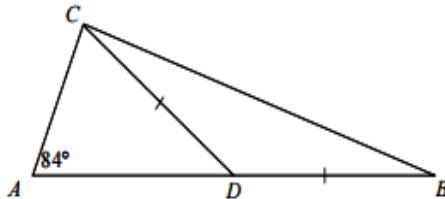
12 [JMO 2003 A6] Given a "starting" number, you double it and add 1, then divide the answer by 1 less than the starting number to get the "final" number. If you start with 2, your final number is 5. If you start with 4, your final

?

number

Exercise 2

- 14 [JMO 2012 A3] In triangle ABC , D is a point on AB such that CD is the angle bisector of $\angle C$ and $AD = DB$. What is the size of $\angle A$?



?

- 15 [JMO 2005 A6] A large container holds 14 litres of a solution which is 25% antifreeze, the remainder being water. How many litres of antifreeze must be added to the container to make a solution which is 30% antifreeze?
Let x be the amount of antifreeze

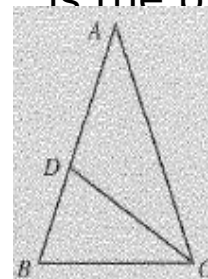
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- 16 [JMC 2012 Q24] After playing 500 games, my success rate in Spider Solitaire is 49%. Assuming I win every game from now on, how many extra games do I need to play in order that my success rate increases to

?


- 17 **(Note: it's easier to just exploit the fact it's multiple choice and try the options!)**

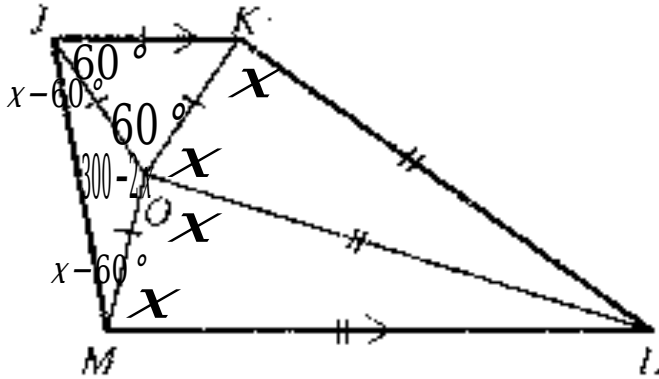
- [JMO 2008 A9] In the diagram, AD is the bisector of angle A in triangle ABC .




?

Exercise 2

-  [JMO 2010 A10] In the diagram, $JK \parallel ML$ and $JM \parallel KL$. Find the size of angle x .




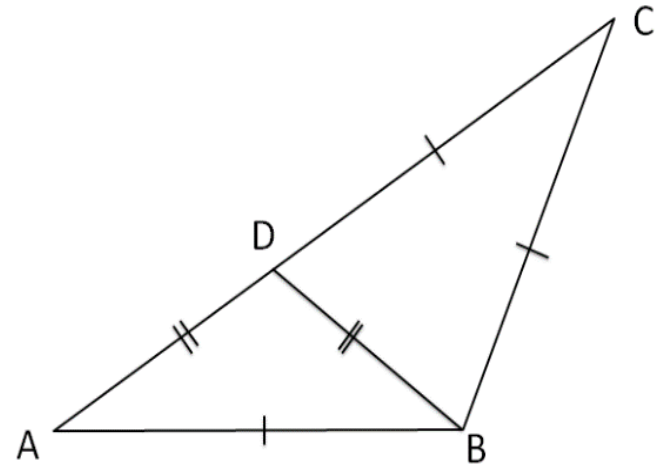
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-  [JMO 2013 B2] Pippa thinks of a number. She adds 1 to it to get a second number. She then adds 2 to the second number to get a third number, adds 3 to the third to get a fourth, and finally adds 4 to the fourth to get a fifth number. Pippa's brother Ben also thinks of a number but he subtracts 1 to get a second. He then subtracts 2 from the second to get a third, and so on until he has five numbers. They discover that the sum of Pippa's five numbers is the same as the sum of Ben's five numbers. What is the

?

Exercise 2

 [JMO 2005 B4] In this figure is a straight line and . Also, . Find the size of . (Full proof needed)



Full proof:

?